Extension of Achankovil shear zone, Southern Granulite Terrain, South India in to Madagascar

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November 22, 2022

Abstract

The Achankovil Shear Zone (AKSZ) is a NW-SE trending ductile shear zone passing through the Southern Granulite Terrain (SGT) has remained enigmatic among scientific community for the perspective of shear zone status and extension. While some consider the AKSZ to represent a Pan African terrain boundary between the Trivandrum block (TB) in the Kerala Khondalite Belt (KKB) and Madurai block (MB) of the SGT (Drury et al. 1984; Santosh, 1987; Harris and Santosh 1994; Santosh et al. 1992, 2005, 2006; Guru Rajesh and Chetty, 2006; Sreejith and Ravindra Kumar, 2013) that can be traced in to now- dispersed crustal fragments of Madagascar and Sri Lanka (Braun and Kriegsman, 2003; Guru Rajesh and Chetty, 2006; Santosh et al. 2009, Sreejith and Ravindra Kumar, 2013). Others consider MB and TB evolved coherently and AKSZ to be a high strain zone (MB is the continuation of TB) within the SGT (Ghosh et al 2004). Detailed structural field work across the SGT suggests that MB and TB are two different blocks and the lineament occurs between these two blocks is the Achankovil Shear Zone (AKSZ). Tracing the paleo-sutures across the rifted crustal fragments is an important method for the reconstruction of the pre-drift crustal assembly. For tracing paleo-sutures detailed structural evolutionary studies are necessary. Available data suggest that the middle and central crustal domains of the present day landmass of Madagascar was with India vis-à-vis East Gondwanaland (comprising India, Australia and Antarctica) that accreted with the West Gondwanaland (comprising Africa), during Late Neoproterozoic and Early Paleozoic (Tucker et al., 1999; Sommer et al., 2003; Collins, 2006). Geologists correlated the AKSZ of India with different major and minor shear zones present in the southern Madagascar, for example Ranotsara shear zone (RSZ), Tranomaro shear zone (TSZ), Angavo shear zone (ASZ) etc. (Tucker et al., 1999; Raharimahefa and Kusky, 2006, 2010; Sajeev et al., 2009; Tucker et al., 2011a, b). Monazites analyzed from the Antananarivo block maintained Neoproterozoic age of 796Ma (Cenki Tok et al, 2016) and also the Imorona–Itsindro Suite of central Madagascar represents 850–750 Ma magmatism (Zhou et al, 2015; Archibald et al, 2016) which is similar to the chronology of Madurai block, SGT. Age of Androyan group (Southern Madagascar) ranges from 560-530 Ma (Jons & Schenk, 2011) obtained from monazites which is similar to the chronology of Trivandrum block, SGT. Taking the arguments a step further, we argue the extension of AKSZ of SGT towards the RSZ of Madagascar which is consistant with the suggestion by Windley et al. 1994; Markl et al. 2000; Cenki et al. 2004; Jons & Schenk, 2011; Zhou et al, 2015; Archibald et al, 2016 based on structural studies and chronology.

T33C-0420

THE ACHANKOVIL SHEAR ZONE, SOUTHERN INDIA: ITS EXTENSION INTO MADAGASCAR

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AGU 100 ADVANCING EARTH AND SPACE SCIENCE | FALL MEETING Washington, D.C. | 10–14 Dec 2018

Key points

- The status of Achankovil Shear Zone (AKSZ) as a terrain boundary shear zone is established from the structural discordance and monazite geochronology across Madurai Block (MB) and Trivandrum Block (TB) of Southern Granulite Terrain (SGT).
- Monazites from MB has given ages (750-800 Ma) similar to that from central Madagascar (750–850 Ma); whereas the ages from TB (550-600 Ma) was similar to the data obtained from south Madagascar (530-560 Ma).
- A coherent model is proposed for placing India and Madagascar in Gondwanaland reconstruction by establishing the extension of Achankovil Shear Zone into Madagascar.
- From the integration of structural and chronological data, we support the argument that the AKSZ of SGT extends into Madagascar as north-west trending Ranotsara shear zone.

Introduction

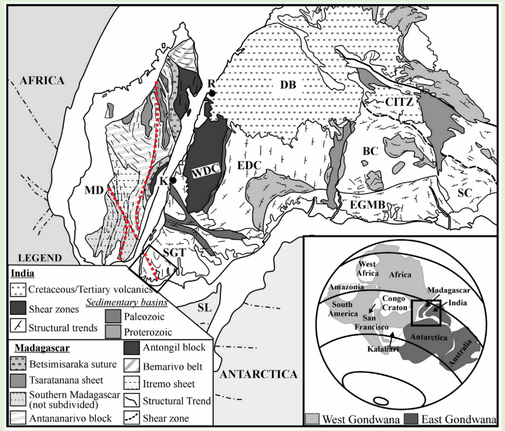

Fig. 1: Paleoposition of India and Madagascar at 500 Ma in the Gondwanaland assembly (modified after Rekha et al., 2013). Inset map shows configuration of India and Madagascar as part of East Gondwana. The red dotted lines shows major shear zones.

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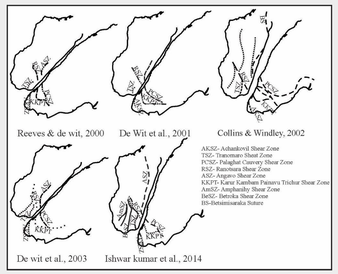
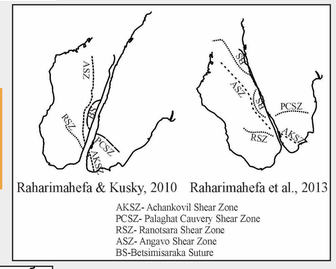
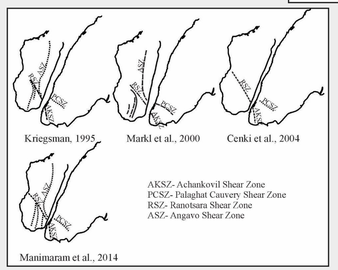
Controversies in correlation



Achankovil Shear Zone
vs
Tranomaro Shear Zone



Achankovil Shear Zone
vs
Angavo Shear Zone



Achankovil Shear Zone
vs
Ranostara Shear Zone

Result:1

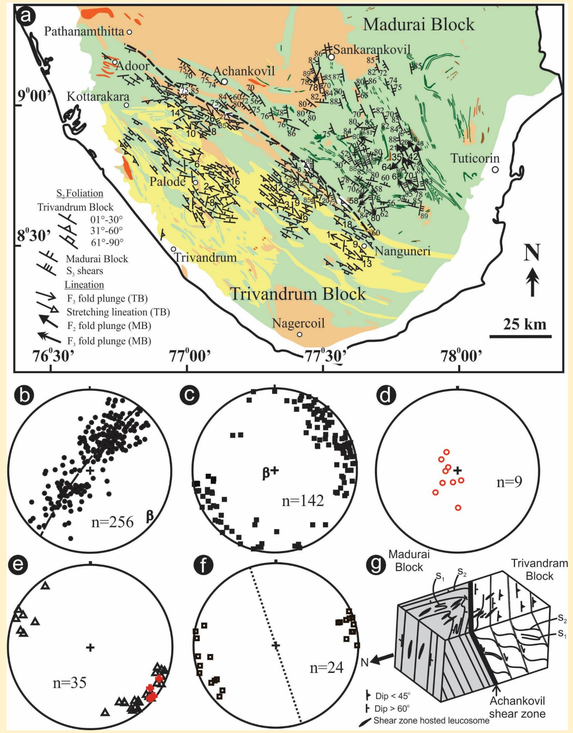


Fig. 2: (a) Lithological map showing foliations (S_2, S_3) and lineations (F_2, F_3). Actual position of AKSZ are shown in the figure with dashed lines. (b–f) Lower hemisphere equal-area projections of foliation and lineation data obtained from MB & TB (g) Schematic block diagram (not to scale) illustrates the deformation structures in the study area.

Result:2

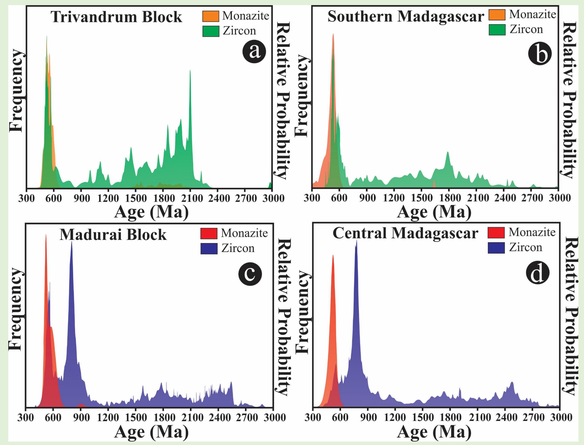


Fig. 3: a-d are the probability density plots from Trivandrum Block, Madurai Block, South Madagascar and Central Madagascar respectively.

Conclusion

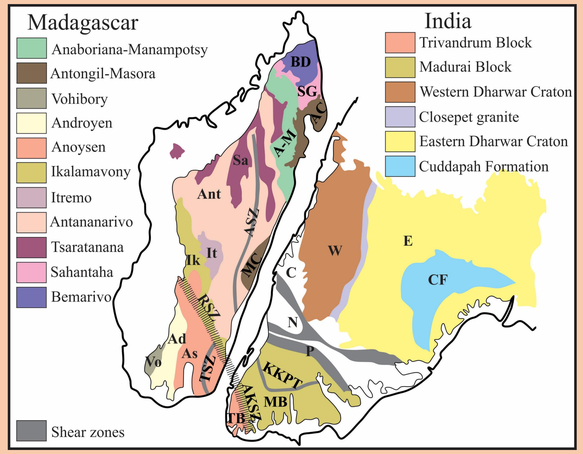
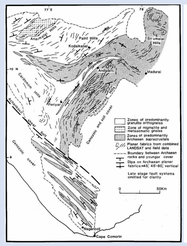
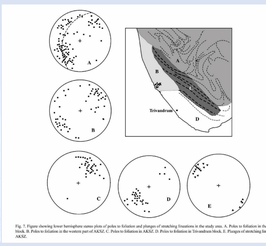


Fig. 4: Proposed paleoposition of Madagascar and India as part of East Gondwana (modified after Rekha et al., 2014).

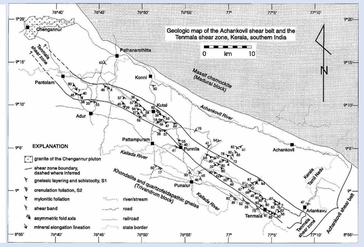
Status of the Achankovil Shear Zone



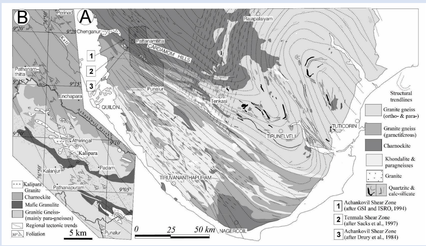
Drury et al., 1984



Rajesh & Chetty, 2006



Sacks et al., 1997



Ghosh et al., 2004

Support of AKSZ

Oppose of AKSZ

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